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GOVERNMENT OF INDIA

METEOROLOGICAL DEPARTMENT

INDIA WEATHER REVIEW, 1948

ANNUAL SUMMARY

PART C

STORMS AND DEPRESSIONS

CONTENTS

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INDIA WEATHER REVIEW, 1948

ANNUAL SUMMARY

PART C

STORMS AND DEPRESSIONS

I.—DEPRESSIONS AND CYCLONIC STORMS

During the year, 4 cyclonic storms and 2 depression formed in the Arabian Sea and 2 cyclonic storms and 11 depressions in the Bay of Bengal. The dates of activity of the storms and the greatest barometric depths observed near their centres are summarised in the following table:—

TABLE I

Locality	Month	Date	Greatest observed barometric depth
Arabian Sea	June	4th-10th	28 mb.
Bay of Bengal	August	12th-18th	15 mb.
Arabian Sea	Sept.-Oct.	23rd Sept.-6th Oct.	20 mb.
Arabian Sea	October	20th-26th	12 mb.
Bay of Bengal	Oct.-Nov.	29th Oct.-4th Nov.	12 mb.
Arabian Sea	November	15th-23rd	20 mb.

The detailed descriptions of these storms and depressions are followed by a list of western disturbances and the more important local storms, and of the localities in which winds of force 9 or more, unconnected with storms, were experienced by ships in the Indian Seas.

1. Deep depression in the Bay of Bengal from 4th to 17th Jan. 1948.—On the morning of the 12th, ships in the extreme south of the Bay reported moderate northwest to west winds and rain showers suggesting an accentuation of the seasonal low over that area. On the 13th morning S. S. Baron at Lat. 10½°N., Long. 84½°E. was experiencing strong winds, heavy squalls and rain while the upper wind over Port Blair at 3000 ft. a.s.l. was southeast force six. By the 14th morning, a depression, apparently deep, had formed with its centre at 0800 hrs. I.S.T. within half a degree of Lat. 11°N., Long. 86½°E. Ships in the northwest quadrant were reporting northeast winds of force seven to eight and heavy squalls, while S.S. Jalamohan at Lat. 10°N., Long. 86°E. was experiencing westerly wind of force five. The deep depression remained practically stationary till 1700 hours of 14th after which it began to weaken. On the morning of the 15th it had weakened into a low pressure area with central region within half a degree of Lat. 11°N., Long. 84°E. Thereafter it weakened further and became unimportant by the 17th morning. In association with this depression, strong northeast monsoon conditions prevailed in the southwest Bay of Bengal between the 13th and 16th.

2. Depression of 3rd to 5th April 1948 in the Bay of Bengal.—On the morning of 2nd April, the upper winds over Port Blair were southeasterly force 5 to 6 at all levels up to 10,000 ft. a.s.l. These, along with the winds over the Coromandel coast and east Ceylon indicated the existence of a well-marked trough of low pressure in the upper air (3000 ft. and above) over the south Bay of Bengal. The trough shifted into the Andaman Sea by the 3rd morning and concentrated into a depression centred at 0800 hrs. I S.T. of that day within half a degree of Lat. 13°N., Long. 94°E. Car Nicobar was reporting northwest winds of force 5 and rain showers while Rangoon and Bassein were experiencing easterly wind and rain or drizzle. The cyclonic circulation associated with the depression was extending up to 10,000 ft. a.s.l. The pressure change chart of the 3rd evening showed a distinct region of comparatively large fall over south Burma indicating the probable northeastward movement of the depression. The depression slightly intensified while moving northeastwards and was centred near Lat. 14°N., Long. 95½°E., on the 4th morning. Thereafter it gradually weakened and moving northnortheast was centred near Lat. 15°N., Long. 96°E., on the morning of the 5th. By the evening of the same day, it crossed the Burma coast and became unimportant.

TABLE 2

Observations recorded by S. S. Schwedagon

Date	*Hrs.* (G.M.T.)	*Wind*	*Bar*	*Ther.*	*Remarks*
4th June	0000	Variable 1	29·60	85	Calm Sea, slight swell fine, clear weather.
	0600	SE 3	29·60	85	Slight Sea —do— —do— —do—
	1200	SE 3	29·64	85	—do— —do— —do— —do— Noon Position Lat. 24°11′ N., Long. 58°31′
	1800	SE 4	29·57	84	—do— —do— —do— —do— E. G.M.T. – 4 hrs.
5th June	2400	SE 3	29·58	80	Calm Sea, slight swell —do— —do—
	0600	SE 3	29·56	80	Slight Sea and swell, fine and clear.
	1200	E 2	29·57	85	Mod. Sea and swell, fine and clear. Noon Position Lat. 22°14′ N., Long. 61°18′ E.
	1800	ENE 5	29·45	83	Rough Sea, Moderate swell, overcast, clear. G.M.T. – 4 hrs.
6th June	2400	ENE 6	29·44	82	Rough Sea, heavy swell, overcast.
	0600	E by N 8	29·28	80	Rough Sea, heavy swell, overcast with heavy rain squalls (hove to heading East).
	1200	E 8	29·27	79	(21°40′ N., 63° 17′E.) —do— —do— —do—
	1800	E by S 9	29·10	78	High Sea, heavy confused swell, continuous heavy rain.
7th June	2400	E by S 9	28·75	77	—do— —do— very heavy squalls and heavy rain.
	0200	SSW 10	28·80	78	Very high Sea and tremendous swell, heavy rain and violent squalls.
	0400	SSW 10	29·00	78	—do— —do— —do—
	0600	SSW 10	29·09	77	—do— —do— —do—
	0800	SW 9	29·14	77	—do— —do— —do—
	1200	SW 9	29·26	77	(21°27′ N., 64°01′E.) Very high sea and confused swell, heavy squalls, visibility improving.
	1800	SSW 8	29·40	78	Rough Sea, heavy swell, cloudy and good visibility.
8th June	2400	SW 7	29·52	77	—do— —do— mainly overcast, good visibility.
	0600	SSW 6	29·50	80	—do— —do— cloudy and clear.
	1200	SW 6	29·62	82	(21°15′ N., 65°09′E.) Sea and swell moderating cloudy and clear.
	1800	SW 5	29·61	84	Moderate sea and swell fine cloudy weather.
9th June	2400	SW 4	29·63	82	Moderate sea and swell fine cloudy weather.
	0600	SSW 4	29·62	82	—do— —do— —do—
	1200	SW 3	29·63	86	(20°07′ N., 68°24′E.) Moderate sea and swell fine cloudy weather.
	1800	SW 3	29·58	86	Moderate sea and swell fine cloudy weather.
	2400	SW 1	29·58	83	Slight sea and swell fine cloudy weather.

During height of storm, sky, when visible, was mainly overcast, with nimbus low over horizon. Ragged cloud formation was only slight. Barometer readings are from aneroid, 25 feet a.s.l. with no index error, as far as is known. Temperature from attached thermometer. Manipulation of barocyclonometer gave results that storm centre passed from ten to twenty miles away.

In association with this depression, fairly widespread rain occurred in Tenasserim and Deltaic Burma on 3rd and 4th.

3. Depression in the Bay of Bengal from the 15th May to 19th May 1948.—On the morning of the 15th pressures were falling over the whole of the Bay of Bengal, the fall being particularly marked over and around the east central Bay. The ships' observations also indicated that conditions were unsettled in the east central Bay and the adjoining parts of the north Andaman Sea.

On the evening of the 15th, H.M.S. Herefordshire reported WNW wind of 8 B.F. and heavy continuous rain near Lat. 13°N., Long. 92°E. while S.S. Jalajyoti near Lat. 15°N., Long. 94½°E. was experiencing southerly wind of 3 B.F. at this time. These observations suggested that the unsettled conditions had developed into a depression with centre at 1700 hrs. near Lat. 14½°N., Long. 92½°E. The depression moved eastnortheastwards and was centred near Lat. 15½°N., Long. 94½°E. at 0800 hrs. I.S.T. of the 16th and near Lat. 16°N., Long. 95°E., at 1700 hrs. I.S.T. on the same day. Thereafter, it curved towards northwest and was centred at 0800 hrs. I.S.T. on 17th near Lat. 19°N., Long. 93°E. Continuing to move in the same direction, the depression was centred close to the coast about 50 miles to the south of Cox's Bazar at 0800 hrs. I.S.T. of the 18th. It then began to weaken without any appreciable movement and became unimportant off the Chittagong coast by the next morning.

In association with the formation and movement of this depression, widespread thunder-rain occurred in Deltaic Burma and north Tenasserim coast on the 15th and 16th, along the Arakan coast on 17th and along the Chittagong coast on 18th. The noteworthy amounts of rainfall are : Rangoon and Tavoy 4″ each on 16th, Rangoon 3″ on 18th, Akyab 3″ on 17th and 18th, and Chittagong 3″ on 18th.

4. Severe cyclonic storm in the Arabian Sea from 4th June to 10th June 1948.—This cyclone was of a very unusual type not only with regard to the region where it formed but also its track. Ships in the southwest and the west central Arabian Sea reported moderate winds, overcast skies and rain on the 3rd June 1948 indicating that the southwest monsoon was advancing into that area and that weather was becoming unsettled in front of the advancing monsoon. By the evening of the 4th, a depression had formed with its central region near Lat. 18°N., Long. 63°E. The depression intensified rapidly without much appreciable movement in the course of the night and became a cyclonic storm of moderate intensity by 0800 hrs. I.S.T. of the 5th. S.S. Singu at Lat. 17°7′N., Long. 66°7′E., reported a south-southwest wind of force 6 at 1030 hrs. I.S.T. and S.S. Caledonia at Lat. 16°8′N., Long. 63°5′E., a southsouthwest wind of force 8 at 1130 hrs. I.S.T. of the 5th. The cyclonic storm was practically stationary till 1700 hrs. I.S.T. and later moving slowly northwards was centred at 0800 hrs. I.S.T. of 6th near Lat. 19½°N., Long. 63°E. Observations recorded by S.S. Schwedagon at 1730 hrs. I.S.T. of 6th showed that the storm was intensifying further. By midnight of 6th-7th the cyclonic storm had become severe and was centred at 0200 hrs. of 7th near Lat. 21½°N., Long. 63°E. The observations of S.S. Schwedagon taken during the different phases of this storm are reproduced in Table 2. A graph showing the barometer readings recorded by the ship for 6th-7th June which is of the V-shape typical of tropical cyclones is also given in *fig.* 1. It is evident from the barogram that the ship, which was bound for Bombay from the Persian Gulf, was within 30 miles of the cyclone centre at midnight of 6th-7th June. The ship was then at Lat. 21° 36′N., and Long. 63° 43′ E. and the lowest barometric pressure of 973.6 mbs. was recorded on board the ship. This would suggest a pressure deficiency of about 28 mbs. at the centre of the storm.

The severe cyclone moved further north and by 0800 hrs. I.S.T. of 7th it was centred near Lat. 22°N., Long. 63°E. and near Lat. 22½° N., Long. 63°E. at 1700

hrs. I.S.T. of 7th. Thereafter the cyclone weakened rapidly in the course of its further northward movement and at 0800 hrs. of 8th June it was centred as a depression near Lat. 25° N., Long. 63° E. The depression crossed the coast near Pasni and then changed its course to northeast. Weakening further, it was centred near Lat. 27°N., Long. 66° E. at 0800 hrs. I.S.T. of 9th. By the morning of the 10th, it merged into the seasonal low over Western Pakistan. In association with this storm, there was local rain in Baluchistan on the 8th and in Sind on the 9th of June.

5. Depression in the Arabian Sea from 12th to 14th June 1948.—The southwesterly and westerly upper winds over Minicoy and over the Malabar coast strengthened considerably on the 10th June indicating establishment of strong monsoon conditions in the southeast Arabian Sea. By 0800 hrs. of the 11th, in front of this fresh surge of monsoon, weather became unsettled in the east central Arabian Sea off the Kanara coast where significant negative pressure changes and departures were noticeable. The upper winds off the Kanara-Konkan coast also showed a feeble cyclonic circulation at least up to 10,000 ft. a.s.l. with southwest to west upper winds of strong to whole gale force in the monsoon sector. By 0800 hrs. I.S.T of the 12th, a shallow depression had formed in the east central Arabian Sea with its centre within half a degree of Lat. 16°N., Long. 72°E. The depression moved northeastwards and crossed the coast near Harnai on the morning of the 13th. In the course of the next 24 hours, it dissipated. With the passage inland of this depression, vigorous monsoon conditions set in along the Konkan coast on the 14th when widespread heavy to very heavy rain fell along the coast. Some of the noteworthy falls in 24 hours ending at 0800 hrs. I.S.T. of 14th were, Dahanu 8″ and Mahabaleshwar 7″.

6. Depression in the Bay of Bengal of 24th to 27th June 1948.—The seasonal trough of low pressure over the Gangetic plain extended into the northwest Bay on the 22nd morning and pressures were falling over and near the same area. On the 23rd morning the cyclonic circulation in the upper air over the northwest Bay became well marked in all the levels suggesting that conditions were markedly unsettled there. The unsettled conditions developed into a depression which was centred at 0800 hrs. I.S.T. of 24th near Lat. 21° N., Long. 89° E. The depression moved north-northwestwards and was centred on the 25th morning close to the coast about 50 miles to the south of Calcutta. It passed inland in the course of the afternoon and was centred slightly to the west of Calcutta in the evening. It continued to move northwestwards and lay on the 26th morning over Chota Nagpur centred about 30 miles to the east of Hazaribagh and on the 27th morning about 20 miles to the northwest of Hazaribagh. It persisted as an extended low over Chota Nagpur during the next 2 days. Meanwhile, a low pressure wave moved across the Arakan coast on the 27th as evidenced by very heavy rain at Akyab and Cox's Bazar. Moving northwestwards, it accentuated the 'low' at its southeastern extremity on the 29th. The low then began to weaken and gradually merged into the seasonal trough of low pressure during the next 48 hours.

In association with this depression, the monsoon extended into West Bengal, Chota Nagpur, Bihar, the east United Provinces and the central parts of the country and caused widespread and locally heavy falls during the last three days of June.

7. Depression of 6th to 12th July 1948 in the Bay of Bengal.—On the 4th July 1948, a low pressure area moved gradually from Deltaic Burma and the neighbourhood westwards into the east central Bay of Bengal around which the pressures that were already falling, fell further and became 3 to 4 mbs. below normal. By the morning of the 5th the low pressure area moved into the north Bay. By the next morning (6th) a depression formed in the north Bay centred at 0800 hrs. I.S.T. near Lat. 20½° N., Long. 88° E. The depression moved slowly westwards, intensified and was centred at 0800 hrs. I.S.T. on the 7th near Lat. 20½° N., Long. 87½° E. Continuing to move in the same direction, the depression crossed the Orissa coast to the south of Chandbali by the same evening. Thereafter it weakened and rapidly moved northwest and lay as a low pressure area on the 8th morning near Pendra. It then recurved and moved northnortheast and was centred about 50 miles to the northwest of Sutna on the 10th morning. The low pressure area then weakened further and merged into the seasonal trough of low over Gangetic plain by the 12th.

This depression was responsible for widespread and locally heavy rain in Orissa, Chota Nagpur, the central parts of the country and the west United Provinces during the course of its movement. Under its influence, the monsoon also extended into east Rajputana on the 9th and temporarily into the east and northwest Punjab on the 13th.

8. Depression in the Bay of Bengal from 27th to 29th July 1948.—On the morning of 26th July 1948, the seasonal trough of low pressure extended into the north Bay of Bengal and the upper winds along the Orissa coast had strengthened and were tending to veer. The pressure changes indicated an area of relatively falling pressure over and near the north Bay. By the same evening, the cyclonic circulation in the upper air over the north Bay had become more marked indicating that conditions had become unsettled over that area.

By the next morning (27th) the unsettled conditions developed into a depression which was centred at 0800 hrs. I.S.T. near Lat. 20° N., Long. 90° E. The depression moved northwestwards and was centred near Saugor Island on the evening of the same day and crossed the coast between Calcutta and Saugor Island at 0200 hrs. I.S.T. on 28th. On the morning of 28th, the depression was centred about 50 miles to the northwest of Calcutta. The depression moved westnorthwestwards and weakening at the same time, it lay next morning about 30 miles to the southwest of Sutna. Weakening further, it merged into the seasonal trough of low pressure by the morning of 30th. In association with the depression, the monsoon which was already active strengthened further over Chota Nagpur, Bihar, the east United Provinces, the central parts of the country and Rajputana. Rainfall was locally very heavy in the central parts of the country and southeast Rajputana.

A table showing noteworthy district averages of rainfall and amounts of particularly heavy rainfall is given below:—

TABLE 3

Province and District	District averages recorded on						Particularly heavy rainfall
	26th	27th	28th	29th	30th	31st	
CENTRAL INDIA							
Dewas Sr.	..	3·3	..	..	..	..	
Makarai	..	4·3	2·8	2·1	..	..	
CENTRAL PROVINCES							
Saugor	..	..	2·1	..	..	..	Garhokota 5·5″ on 28th.
Jubbulpore	2·1	..	..	..	..	..	Khitoli 5·1″ on 26th : Amari 5·0″ on 26th.
Nimar	..	.	..	2·9	..	..	Khandwa 7·0″ on 29th.
Amraoti	..	..	..	2·4	.	..	Chikalda 7·0″ on 28th.
Yeotmal	..	..	..	2·1	.		

9. Cyclonic storm in the Bay of Bengal of 12th to 18th August 1948.—On the morning of 9th August, the seasonal trough of low pressure was extending into the west central Bay of Bengal and the adjoining parts of north-west Bay. By the next morning, a cyclonic circulation extending up to 10,000 ft. had appeared off the Circars-Orissa coast indicating that conditions were becoming unsettled there. The unsettled conditions concentrated during the course of the next two days and by the morning of the 12th, a depression had formed with its centre at 0800 hrs. I.S.T. within half a degree of Lat. 18° N., Long. 86½° E. The depression intensified during the course of the next 24 hrs. and lay as a deep depression with its centre at 0800 hrs. I.S.T. on the 13th within half a degree of Lat. 18½° N., Long. 86½° E. S. S. Risaldar which was about 50 miles to the west of the centre of the depression was experiencing winds of force 7 at this time. The deep depression then began to move northwards and, intensifying into a cyclonic storm of small extent lay at 1700 hrs. I.S.T. on the same day with its centre near Lat. 19° N., Long. 87° E. S. S. Begum which was close to the centre of the storm was experiencing winds of force 9 B.F. Continuing to move northwards, the cyclonic storm was centred at 0800 hrs. on the 14th near Lat. 20° N., Long. 87° E. The pressure deficiency at the centre of the storm had by this time become about 15 mbs. and the extent of the storm field had also slightly increased. Ships in the southern quadrant even about 150 miles from the centre, were reporting squally winds of force 8 or more. The storm then moved northwestwards and crossed the coast to the south of Chandbali by the 14th noon, weakened and lay at 1700 hrs. I.S.T. as a deep depression with its centre close to Cuttack. Then it began to move westnorthwestwards and weakening at the same time it lay on the 15th morning with its central region near Sambalpur and as a depression on the 16th morning with its central region between Umaria and Pendra. It then moved slowly northwards and weakening further, lay centred about 30 miles east of Sutna on the 17th morning. It moved into the southern districts of the east United Provinces as a diffuse low by the 18th morning and became unimportant during the course of the next 24 hours. Under the influence of this storm, the monsoon was active over the region from the north Konkan and Gujarat to the Circars coast, locally heavy rain occurring in the north Konkan, the east Central Provinces and along the Orissa-Circars coast. The noteworthy district averages and amounts of particularly heavy rainfall are given in the following table :—

TABLE 4

Province and District	District averages on					Particularly heavy falls
	13th	14th	15th	16th	17th	
ORISSA						
Cuttack	..	..	2·1	..	..	On 15th, Jagatsingpur 10·2″, Banki 7·9″, Cuttack 7·5″.
Puri	..	3·2	4·2	..	..	On 14th, Khurda 4·5″, Tanghi 5·5″. On 15th, Puri 6·1″, Khurda 8·7″, Banpur 5·7″, Gop. 8·0″ and Pipli 12·0″.
Sambalpur	..	..	2·0	..	..	On 15th, Padampur 6·7″.
Ganjam	..	2·4	3·7	..	..	On 14th, Kudala 5·9″, G. Udaygiri 5·1″ Balandapara 4·7″. On 15th, Surada 4·6″, Daringabadi 4·5″, Balliguda 6·2″, R. Udaygiri 5·2″, Mohana 4·9″, Phiringia 6·2″, Khejuripara 7·0″, Phulbani 6·1″, Balandapara 6·2″.

TABLE 4—*contd.*

Province and District	District averages on					Particularly heavy falls
	13th	14th	15th	16th	17th	
CENTRAL INDIA						
Shajapur	..	..	3·3	..	..	On 15th, Shajapur 6·9″.
Morena	..	..	..	..	2·7	On 17th, Jaura 4·8″.
Mahidpur	..	..	..	4·3	..	On 16th, Mahidpur 4·6″.
Eastern districts	..	..	..	3·2	..	On 16th, Shahganj 5·6″.
Western districts	..	..	..	3·0	..	On 16th, Ashta 8·3″.
Dewas Junior	..	..	..	..	3 9	
CENTRAL PROVINCES						
Drug	..	..	6·0	4·1	..	On 15th, Drug 7·9″, Sanjari 6·7″, Khapari 10·8″, Bhatagaon 11·1″, Selod 8·0″. On 16th, Sanjari 6·0″, Adamabad 9·0″.
Raipur	..	..	4·8	3·1	..	On 15th, Dhamtari 12·1″, Gariabund 8·0″, Mahasamund 6·5″, Rudri 6·0″, Maramsilli 6·1″, Bhatagaon 8·2″, Kondapar 7·9″, Kendri 6·3″. On 16th, Dhamtari 7·8″, Rudri 6·0″, Maramsilli 8·1″, Bhatagaon 6·7″.
Bhandara	..	..	..	5·1	..	On 16th Khyrbund 9·7″, Pangree 7·3″, Deori 7·5″.
Balaghat	..	..	..	5·5	..	On 16th, Baihar 5·0″, Lanji 7·4″, Waraseoni 7·9″, Lal Burra 8·5″, Sarathi 8·9″, Jamunia 6·9″, Kattanjhiri 8·2″, Dhuti 5·7″, Dongagaon 6·5″.
Hoshangabad	..	..	..	..	..	On 15th Mohpani (Gotitour) 7·5″. On 16th Sohagpur 6·8″, Pachmarhi 6·9″.
Chhindwara	..	..	..	..	..	On 16th Harra 6·1″, Tamia 5·9″, Ari 5·7″, Bori 7·1″.

10. Depression in the Bay of Bengal of 23rd and 24th August 1948.—The seasonal trough of low pressure was extending into the north Bay of Bengal on the morning of the 22nd. On the evening of the same day, pressures began to fall along the Arakan-Chittagong coast and the neighbourhood and the pressure change and departure charts suggested the existence of a low pressure area over and near central Burma and its movement westwards into the north Bay. By the next morning, the trough of low pressure over north Bay concentrated into a depression centred at 0800 hrs. I.S.T. near Lat. 21° N., Long. 88½° E. Moving slowly westnorthwestwards, the depression was centred at 0800 hrs. I.S.T. of 24th about 50 miles to the southwest of Saugor Island. It crossed the Orissa coast near Balasore on the same afternoon and was centred at 1700 hrs. I.S.T. on that day just to the northwest of Balasore. Thereafter it weakened and lay as a trough of low pressure over north Orissa, Chota Nagpur and the neighbourhood on the morning of the 25th. It then moved slowly westnorthwestwards and lay over the southern districts of the west United Provinces on the 1st September. It then slightly recurved eastwards and became unimportant by the 3rd September. This depression helped to maintain the activity of the monsoon over the central parts of the country, the United Provinces and east Rajputana. Locally heavy falls occurred in west Central India, between the 26th August and 1st September, in the west Central Provinces between the 26th and 29th and in the west United Provinces between 28th August and 1st September.

11. Depression of the 19th to 23rd September 1948 in the Bay of Bengal and cyclonic storm of the 23rd September to 1st October 1948 in the Arabian Sea.—On the morning of the 15th September pressures were falling in general all over the Bay and the adjoining land areas, but an area of comparatively lower barometric pressure was noticed over Deltaic Burma and the Arakans. The upper winds over Akyab showed a tendency to back and became northeasterly to northerly at all levels upto 10,000 ft. a.s.l. This indicated that a low pressure wave was moving westwards across Deltaic Burma and the neighbourhood. The seasonal trough of low pressure was also extending over the north Bay on the same morning. By the morning of 18th, the low pressure wave had emerged into north and central Bay of Bengal and conditions had become markedly unsettled there. The unsettled conditions gradually moved westwards and concentrated into a depression centred at 0800 hrs. I.S.T. of 19th near Lat. 17° N., Long. 85½° E. The depression moved slightly westwards and was centred about 70 miles to the southeast of Vizagapatam at 1700 hrs. of the same day (19th). At 0200 hrs. I.S.T. of 20th, it was close to the coast near Vizagapatam where it remained practically stationary till 1700 hrs. of 21st. It crossed the coast near Vizagapatam during the night of 21st, moved westnorthwestwards and lay over east Hyderabad on 22nd morning with its central region near Hanamkonda. At the same time, a trough of low pressure appeared off the Konkan coast. Moving westwards the depression emerged into the trough in the Arabian Sea during the night and by the next morning (23rd), a deep depression had developed in the Arabian Sea centred about 50 miles southwest of Bombay. The pressure deficiency at the centre of the depression at this time might have been about 14 mbs. Meanwhile, the monsoon had also strengthened along and off the Konkan coast. Devgad reported 9″ during the 24 hours ending at 0800 hrs. of 23rd. In association with this vigorous pulse of the monsoon, the depression intensified rapidly into a cyclonic storm of small extent in the course of 23rd, its centre at 1700 hrs. I.S.T. being near Lat. 19° N., Long. 72° E. Bombay was at that time reporting SSE wind of force 8. Moving northwestwards and slightly intensifying further, the cyclonic storm lay with its centre near Lat. 19½° N., Long. 71½° E. at 0800 hrs. of 24th. S.S. Almerstazaate reported at Lat. 18·7° N., and Long. 70·8° E. westerly 9 B.F. winds and very rough seas at 0930 hrs. I.S.T. of 24th. Continuing to move northwestwards, the cyclonic storm was centred about 50 miles south of Veraval at 1700 hrs. of 24th and 50 miles west of Veraval at 0200 hrs. of 25th. The hourly observations of Veraval from 1400 hrs. of 24th for the next 24 hours, given below will be of interest :—

TABLE 5

Date	Time IST.	Corrected pressure	Wind Dir.	Force	Cloud	Remarks
		mbs.				
24-9-48	1400	994·1	ENE	9 B.F.	Overcast	Raining
,,	1500	993·6	ENE	8 B.F.	,,	Drizzling
,,	1600	992·7	ENE	8 B.F.	,,	
,,	1700	992·9	ENE	8 B.F.	,,	Drizzling
,,	1800	992·9	ENE	8 B.F.	,,	,,
,,	1900	993·0	E	9 B.F.	,,	
,,	2000	994·1	SE	8 B.F.	,,	Raining
,,	2100	993·4	SE	9 B.F.	,,	
,,	2200	995·3	SE	8 B.F.	,,	
,,	2300	995·0	SE	9 B.F.	,,	Raining
25-9-48	0000	995·2	SSE	8 B.F.	,,	,,
,,	0100	994·7	SSE	9 B.F.	,,	,,
,,	0200	995·0	SSE	9 B.F.	,,	,,
,,	0300	995·0	SSE	8 B.F.	,,	,,
,,	0400	995·8	SSE	8 B.F.	,,	,,
,,	0500	996·2	SSE	8 B.F.	,,	,,
,,	0600	996·6	SSE	7 B.F.	,,	,,
,,	0700	998·1	S	8 B.F.	,,	
,,	0800	998·7	SSW	8 B.F.	,,	,,
,,	0900	999·0	SSW	8 B.F.	,,	,,
,,	1000	999·4	SSW	8 B.F.	,,	,,
,,	1100	999·3	SSE	8 B.F.	,,	,,
,,	1200	999·3	S	8 B.F.	,,	Drizzling
,,	1300	998·8	S	8 B.F.	,,	

The cyclonic storm then slowly curved westwards and was centred at Lat. 21½° N., Long. 68½° E. on the morning of 26th, at Lat. 21½° N., Long. 67½° E. at 0800 hrs. of 27th and a degree to the west of this position at 0800 hrs. I.S.T. of 28th. S.S. Dara and S.S. Europe reported the following observations at 0600 GMT. of 28th.

TABLE 6

Name of Ship	Time GMT	Position		Wind		Clouds	Remarks
		Lat.	Long.	Dir.	Force		
S. S. Dara	0600	22° N	67° E	ENE	½ BF	Sky discernible	Squally
S. S. Europe	,,	21½°N	66° E	N	9 BF	,,	Line squall

The cyclonic storm continued its westward course and struck the Arabian coast near Ras-el-had on the evening of the 1st October and filled up rapidly thereafter.

Under the influence of the depression and the storm the monsoon strengthened in Orissa, Chota Nagpur, the east Central Provinces and the Peninsula outside southeast Madras where fairly widespread rain fell between 20th and 22nd. Rainfall continued to be widespread in the Bombay Province, west Hyderabad, the Central Provinces and Central India on 23rd. Locally heavy rain fell along the Konkan coast on the 24th morning. Devgad reported 9″ during the 24 hours ending 0800 hrs. of 23rd. Noteworthy district averages of rainfall and amounts of particularly heavy rainfall are given in the following table:—

TABLE 7

Province and District	District averages on 23rd	Particularly heavy rainfall
BOMBAY		
Poona		On 23rd, Sirur 5·8″.
Thana		On 23rd, Shahapur 4·9″.
Bombay	2·4	
Kolaba	2·0	
Ratnagiri	4·6	On 23rd, Ratnagiri 9·8″, Malvan 5·5″, Devgad 10·3″, Rajapur 9·9″, Lanja 6·0″, Kankavli 6·9″.

12. Shallow Depression in the Bay of Bengal of 27th September to 29th September and of 2nd October to 3rd October 1948.—On the morning of 23rd September, pressures were falling along the Chittagong-Arakan coast and the upper winds along the coast had become northerly below 3,000 ft. a.s.l. suggesting that a low pressure wave was moving westwards into the Bay. On the next morning (24th) the upper winds over Akyab veered from north to east and the low pressure wave passed into the central Bay, a trough of low pressure appearing on the surface chart in the same region. The trough gradually moved westwards and by the morning of the 26th, it became well-marked over the west central Bay and the northwest Bay where a cyclonic circulation was seen in the upper air up to 10,000 ft. a.s.l. By 0800 hrs. I.S.T. of the 27th, the trough of low pressure concentrated into a shallow depression centred near Lat. 17½°N., Long. 88° E. Moving in a northwesterly direction, the depression was centred at 0800 hrs. I.S.T. of 28th near Lat. 18½° N., Long. 87° E. and at 0200 hrs. I.S.T. of 29th about 50 miles to the eastnortheast of Puri. The depression weakened and passed inland across the Orissa coast by the afternoon of 29th and lay as an extended low over Orissa and the neighbourhood on the morning of the 30th. Moving northeastwards, it lay over Gangetic West Bengal and

the head of the Bay of Bengal on the morning of 1st October. The low pressure area concentrated again at its southern end in association with a fresh low pressure wave from central Burma and, by the morning of the 2nd October, a depression had formed at the head of the Bay of Bengal with centre at 0800 hrs. I.S.T. near Lat. 20½° N., Long. 90° E. The depression rapidly moved northwestwards and, crossing the Sunderbans coast between Saugor Island and Barisal during the early hours of the 3rd, lay at 0800 hrs. I.S.T. on the 3rd with the central region to the north of Krishnagar. Thereafter it weakened and became unimportant during the course of the next 24 hours.

In association with these developments, fairly widespread rain fell in Assam, West Bengal, Orissa and north Madras coast on 28-9-48, over the belt extending from Assam to east Central Provinces and along north Madras coast on the 29th September and practically over the whole of northeast India from 1st to 3rd October. The noteworthy district averages of rainfall and amounts of particularly heavy falls are given below.

TABLE 8

Province and District	District averages on		Particularly heavy falls
	2nd	3rd	
ASSAM			
Goalpara . .	2·5	4·1	On 2nd, Kachugaon 4·5″ Damra 4·5″. On 3rd, Dhubri 5·1″, Kachugaon 5·4″, Goalpara 8·3″.
Kamrup . .	..	..	On 2nd, Barduar 4·9″.
Garo hills .	3·3	3·6	On 2nd, Tura 6·3″. On 3rd, Mahendraganj 4·8″.
Khasi and Jaintia Hills . .	2·0	2·3	On 1st, Cherrapunji 8·4″. On 2nd, Cherrapunji 6·1″.
Abor Hills .	2·6	..	

13. Shallow depression in the Arabian Sea of 3rd to 5th October 1948.—On the morning of 2nd October, *i.e.* soon after the previous cyclone had passed inland, the upper winds at Karachi turned to south to southeast at 10,000′ and 12,000′ a.s.l. By the same evening, the winds along Sind-Mekran coast were affected from 5,000′ upwards and aircraft flying parallel to the coast reported easterly winds at 10,000′. A fall of pressure also occurred in the north Arabian Sea during the course of the next 24 hrs. and a trough of low pressure appeared in the northeast Arabian Sea off the Kathiawar coast at 1700 hrs. I.S.T. of 3rd October Dwarka reporting southsoutheasterly 5 B.F. winds. The upper winds also indicated a cyclonic circulation at least up to 10,000′ a.s.l. By early morning of the 4th a shallow depression had formed with central region at 0200 hrs. I.S.T. near Lat. 22° N., Long. 67° E. It moved rapidly eastwards and crossed the coast near Dwarka by 0800 hrs. I.S.T. of 4th. The pressure departure at Dwarka at this time was —4·6 mbs. At 1700 hrs. of 4th, the centre of the shallow depression was over the Gulf of Cutch just to the west of Jamnagar. The depression then weakened into a trough which lay over Cutch and lower Sind on the morning of the 5th. The trough became unimportant during the course of the next 24 hours.

This shallow depression caused moderate to heavy showers in famine-affected west Kathiawar. Junagadh reported 6·9″ of rain on 5th October while Kotda-Sangani in Gujarat reported 4·9″ and Veraval 1″ on the 4th.

14. Depression in the Bay of Bengal of 5th to 8th October 1948.—On the morning of 3rd October, a low appeared on the surface chart over the Gulf of Siam and the adjoining land areas. The pressures along the Tenasserim coast began to fall and the upper winds over the same area became northerly to northwesterly suggesting the movement of a low pressure area westwards into the Andaman Sea. On the morning of the next day, pressures fell further over the Andaman Sea and the upper winds along the Tenasserim coast veered from northwest and north to northeast suggesting that the low pressure area was moving across Tenasserim into the Andaman Sea and that conditions were becoming unsettled there. By the 5th morning, a cyclonic circulation had established itself in the upper air up to 5,000 ft. over the Andaman Sea and by the same evening a depression formed there and was centred at 1700 hrs. I.S.T. near Lat. 15° N., Long. 96° E. The depression moved northwest and was centred at 0800 hrs. I.S.T. of 6th near Lat. 17° N., Long. 93½° E. Continuing to move northwest, it was centred on the next morning (7th) near Lat. 18° N., Long. 92½° E. The depression slightly intensified and was centred on the evening of 7th near Lat. 18½° N., Long. 92½° E. It recurved northnortheastwards and crossed the Arakan coast near Akyab on the 8th evening. Thereafter, the depression weakened and gradually became unimportant.

In association with the formation and movement of the depression, widespread rain occurred in the Tenasserim coast and in the Bay Islands from 4th to 7th.

A few noteworthy falls recorded during the 24 hours ending at 0800 hrs. I.S.T. of the dates mentioned against each are given below:—

TABLE 9

Station	Rainfall in inches	Date
Victoria Point	4″	4-10-1948
Port Blair	5″	4-10-1948
Bassein	2″	6-10-1948
Rangoon	2″	7-10-1948
Akyab	6″	8-10-1948

15. Cyclonic storm in the Arabian Sea of 20th to 26th October 1948.—With the setting in of the northeast monsoon over south Malabar, Comorin and the neighbourhood, a trough of low pressure appeared over the southeast Arabian Sea on the 17th October. During the next 24 hours, pressures continued to fall along the Malabar-Kanara coast and over Laccadive Islands, and, on the 18th morning, a cyclonic circulation extended up to about 3,000 ft. a.s.l. over the Laccadives area. These observations suggested that the trough might concentrate into a depression. In the course of the next 48 hours, the trough moved slightly westwards, concentrating at the same time. By 0800 hrs. I.S.T. of the 20th, it developed into a depression with central region near Lat. 8° N., Long. 72° E. The depression moved northwestwards and at 0800 hrs. I.S.T. of the 21st, it was centred near Lat. 9° N., Long. 71° E. During its further northwestward movement, it deepened and at 0800 hrs. of the 22nd, its centre lay near Lat. 11° N., Long. 66° E. The deep depression maintained its northwesterly course, intensifying at the same time and by 0200 hrs. of 23rd, it was a cyclonic storm centred near Lat. 12° N., Long. 63° E. S. S. Itinda reported northwest 8 B. F. winds near Lat. 12° N., Long. 62° E. at midnight of 22nd. The pressure deficiency at this stage at the centre of the storm must have been at least 12 mbs. At 1700 hrs. of the same day (23rd) the cyclonic storm was centred at Lat. 13° N., Long. 61½° E. No ships observations are available thereafter to fix the position of the cyclone accurately. However the following coastal observations give a clue about the subsequent movement of the cyclone. Salalah on the Arabian coast reported northerly 5 B.F. winds and rain and Masirah northeasterly 5 B.F. winds at 1200 G.M.T. of the 24th. Masirah experienced eastnortheast winds of force 5 to 6 B. F. and rain on the night of the 24th and till 0300 G.M.T. of the 25th. but by 0600 G.M.T. of 25th, the wind at Masirah veered to southsoutheast 4 B.F., the rain stopped and the sky was half covered with

large Cumulus clouds. S. S. Thamesfield reported at 1200 G.M.T. of 25th, southeast 5 B. F. winds and fair weather with three tenths of clouds near Lat. 20° N., Long. 59½° E. These observations indicated that the cyclone crossed the Arabian coast near Kuria Muria during the course of 25th. The cyclone weakened thereafter into a depression and curved northwards. Sharjah reported rain at 1700 hrs. of 25th and 0200 hrs. of the 26th and recorded half an inch till 0800 hrs. of 26th. The surface winds at that station also gradually veered from northeast on 25th evening to southeast on 26th morning and to southwest on 26th evening. The depression, therefore, appears to have passed northwards slightly to the west of Sharjah on the morning of 26th. It rapidly weakened thereafter, and became unimportant.

16. Cyclonic storm in the Bay of Bengal of 29th October to 4th November 1948.—On the morning of the 28th October, the upper winds over the Andaman Sea showed a well-defined cyclonic circulation extending up to 5,000 ft. a. s. l. Pressures were also falling briskly over this region. Victoria Point had recorded 2″ of rain and Port Blair was experiencing continuous rain at 0800 hrs. I.S.T. These observations indicated that conditions were becoming unsettled in the Andaman Sea. By the 29th morning, there was a further fall of pressure over the Andaman Sea and the unsettled conditions had concentrated into a depression which was centred at 0800 hrs. I.S.T. near Lat. 9° N. Long. 91° E. By the next morning, the depression had become deep and was centred near Lat. 10° N., Long. 90½° E. Continuing to move northwestwards, the depression intensified into a cyclonic storm and was centred at 0800 hrs. I.S.T. of the 31st within a degree of Lat. 12° N., Long. 88° E. Ships situated as far away as 250 miles from the centre of the disturbance were experiencing squalls and heavy rain at this time and Port Blair which was 300 miles away to the east of the centre of the disturbance was experiencing a steady wind of 25 knots and continuous rain. The cyclonic storm continued to move northwestwards and was centred at 0800 hrs. I.S.T. of 1st November near Lat. 15° N., Long. 86° E. Thereafter the storm took a westnorthwesterly course and moved at a slower rate. It was centred at 1700 hrs. of 1st November near Lat. 15½° N., Long. 84½° E. and near Lat. 16° N., Long. 82° E. at 0200 hrs. I.S.T. on 2nd November. It crossed the coast just to the north of Masulipatam at about 0800 hrs. I.S.T. of the 2nd. It then weakened into a depression and was centred 50 miles southeast of Hyderabad on the 3rd morning and as a diffuse low over west Hyderabad with central region between Bijapur and Gulbarga on the morning of the 4th. It became unimportant during the course of the next 24 hours.

Associated with this storm, there was widespread rain along the Orissa coast between the 1st and 3rd, in the Madras Deccan and along Circars coast on the 2nd and 3rd, and in Gangetic West Bengal on the 2nd. It also caused fairly widespread rain in the Madras Presidency, Hyderabad and Berar on the 4th and 5th and in the west Central Provinces on the 5th.

17. Severe cyclonic storm of 15th to 23rd November 1948 in the Arabian Sea.—On the 13th November, a low pressure wave was noticed moving westwards across the extreme south of the Bay of Bengal. It revived the northeast monsoon along the south Coromandel coast and caused widespread and locally heavy rain over that area on the 15th and 16th. Continuing to move westwards, the low pressure area passed out into the southeast Arabian Sea on the 16th afternoon and, under its influence, locally heavy rain occurred over the Comorin area Trivandrum recording 6″ and Nagercoil 5″ in 24 hours ending at 0800 hrs. of the 17th, most of the rain having occurred during the 16th-17th night.

By the 17th evening, the low pressure area had shifted further westnorthwestwards and lay over the Laccadives and the adjoining areas of the southeast Arabian Sea. The low pressure area thereafter moved northwestwards and concentrated into a depression on the 18th morning with central region near Lat. 11° N., Long. 70° E. Very few ships' observations are available from the central region of the depression for the next 24 hours but from the available observations, it appears that by the morning of 19th, the depression had become deep and was centred near Lat. 16° N., Long. 66° E. The deep depression moved practically northwards during the next 9 hours. S. S. Thomas Cresap at a distance of about 120 miles northeast of the depression centre at 0900 hrs. G. M. T. reported E/S 7 B. F. winds and S. S. Zuidercruies about 100 miles east of S. S. Thomas Cresap reported SE 7 B. F. winds at 1200 G. M. T. indicating that the depression had further intensified and was probably a cyclonic storm by 1700 hrs. of the 19th, centred near Lat. 17° N., Long. 66° E.

At this stage, the cyclonic storm began to recurve northeastwards and at 0800 hrs. I.S.T. of 20th, it was centred near Lat. 18° N., Long. 66½° E. In the course of the next few hours, the cyclonic storm intensified further and by 1400 hrs. I.S.T. it was severe and was centred near Lat. 18½° N., Long. 66½° E. The pressure deficiency at the storm centre at this stage must have been at least 15 mbs. The ships S. S. Timao and S. S. Lieve Vrouwekerk both of which were approaching Bombay from Aden, were caught in the cyclone and their observations between 19th and 22nd November which are interesting in this connection are given below :—

TABLE 10

Observations recorded by S.S. Timao

Date	Time GMT	Lat.	Long.	Wind Dir.	Wind Force	Cloud	Remarks
19-11-48	0700	17° 48′N	61° 50′E	ENE	3 B.F.		
19-11-48	1100	18° 05′	62° 35′	N	6 B.F.		
19-11-48	1500	17° 55′	63° 10′	N	6 B.F.		Squall at 1400
20-11-48	0300	17° 46′	65° 27′	NW/W	6 B.F.		
20-11-48	1500	18° 05′	67° 40′	SW/W	7 B.F.		
21-11-48	0300	17° 45′	69° 13′	WSW	6 B.F.		
22-11-48	1200	18° 20′	72° 05′	SW/W			

TABLE 11

Observations recorded by S. S. Lieve Vrouwekerk

Date	Time GMT	Lat.	Long.	Wind direction	Wind force & Cloud	Pressure
19-11-48	0000	17° 06′N	62° 18′E			1008.8 mbs.
19-11-48	0600	17° 12′	63° 18′			1008·2 mbs.
19-11-48	1200	17° 24′	64° 18′			1004.6 mbs.
19-11-48	1800	17° 30′	65° 18′			999.1 mbs.
20 11-48	0000	17° 30′	66° 00′			997 5 mbs.
20-11-48	0600	17° 36′	66° 54′	SW	9 B.F. Overcast	999.6 mbs.
20-11-48	1200	17° 36′	67° 18′	SW	8 B.F. Overcast	999·1 mbs.

TABLE 11—*contd.*

Date	Time GMT	Lat.	Long.	Wind direction	Wind force & Cloud	Pressure
20-11-48	1800	18° 00′	68° 00′			999.5 mbs.
21-11-48	0000	18° 12′	68° 36′			1000.0 mbs.
21-11-48	0600	18° 18′	70° 00′	SW	9 B.F. Overcast	1000.8 mbs.
21-11-48	1200	18° 18′	70° 00′	WSW	9 B.F. Cloudy	1002.6 mbs.
21-11-48	1800	18° 18′	69° 42′			1003.2 mbs.
22-11-48	0000	18° 24′	69° 30′			1004.7 mbs.
22-11-48	0600	18° 24′	70° 00′			1008.4 mbs.
22-11-48	1200	18° 24′	70° 30′			1007.8 mbs.
22-11-48	1800	18° 24′	70° 36′			1010.0 mbs.

Remarks :—(S. S. Lieve Vrouwekerk.)

18-11-48.—Overcast sky northeasterly wind becoming stronger. During the night time more and more clouds and on the morning of 19th, fully overcast sky. Fb. clouds, wind force 7 B. F. backing to north and swell coming from north-northeast. At 0230 hrs. on 19th, northerly winds force 5 B. F. swell from northnortheast 5 and fully overcast sky with showers. After 1130 wind force 8-9 B. F. high wild sea and swell from different directions; wind was backing to south-west at 1900 GMT., pressure 1000.7 mbs. ship was rolling very heavily and much water on deck.

20-11-48.—0130 GMT Weather was getting worse position of ship Lat. 17° 45′ N., and Long. 67° 18′ E., wind southsouthwest, 9 B.F. very high and wild sea and very high southsouthwest swell, pressure 997.1 mbs. and very heavy rains. The wind was veering to westsouthwest between 0630 and 1130 GMT on 21st. Pressure stationary at 1001.0 mbs. Very heavy rolling ship. Position of ship at 1130 hrs. GMT of the 21st, Lat. 18° 30′ N., Long. 70° 07′ E., wind 9-10 B. F. very WSW high swell, high and wild sea pressure 1001.1. At night of 22nd November weather was getting better and better and pressure higher and higher, but sea very rough and high swell from all directions.

At 1700 hrs. of the same day, (20th) the severe cyclone was centred near Lat. 18½°N., Long. 67° E. At this stage the upper winds along the north Konkan coast strengthened from 6 to 8 B.F.; the later deterioration of weather along the Kathiawar and Konkan coast may be seen from observations of Veraval and Bombay given below:—

TABLE 12

Date	Time I.S.T.	Pressure in mb.	Wind		Cloud	Rainfall in 24 hrs.	Remarks
			Dir.	Force			
VERAVAL							
20-11-48	0200	1009·8	Calm	..	Cloudy	..	
20-11-48	0800	1010·7	NE	2 BF	Overcast	0·00	
20-11-48	1700	1008·8	S	1 BF	„	..	Thunder with rain
21-11-48	0200	1006·3	ESE	5 BF	„	..	
21-11-48	0800	1003·4	ENE	6 BF	„	2·08″	Rain
21-11-48	1700	997·6	NE	7 BF	„	..	Rain
22-11-48	0200	1002·0	NNE	8 BF	„	..	
22-11-48	0800	1006·2	NNE	4 BF	„	3·52″	

TABLE 12—*contd.*

Date	Time I.S.T.	Pressure in mbs.	Wind		Cloud	Rainfall in 24 hrs.	Remarks
			Dir.	Force			
BOMBAY (COLABA)							
19-11-48	0800	1011·3	ENE	1 BF	Overcast	0·00	
19-11-48	1700	1010·0	WSW	2 BF	„	..	
20-11-48	0800	1011·6	SE	3 BF	„	0·00	
20-11-48	1700	1008·0	SSW	4 BF	„	..	
21-11-48	0800	1008·1	SE	4 BF	„	0·00	Past weather rain
21-11-48	1700	1004·0	SSE	7 BF	„	..	Thunderstorm
22-11-48	0800	997·6	SW	8 BF	„	3·97″	Thunder with rain

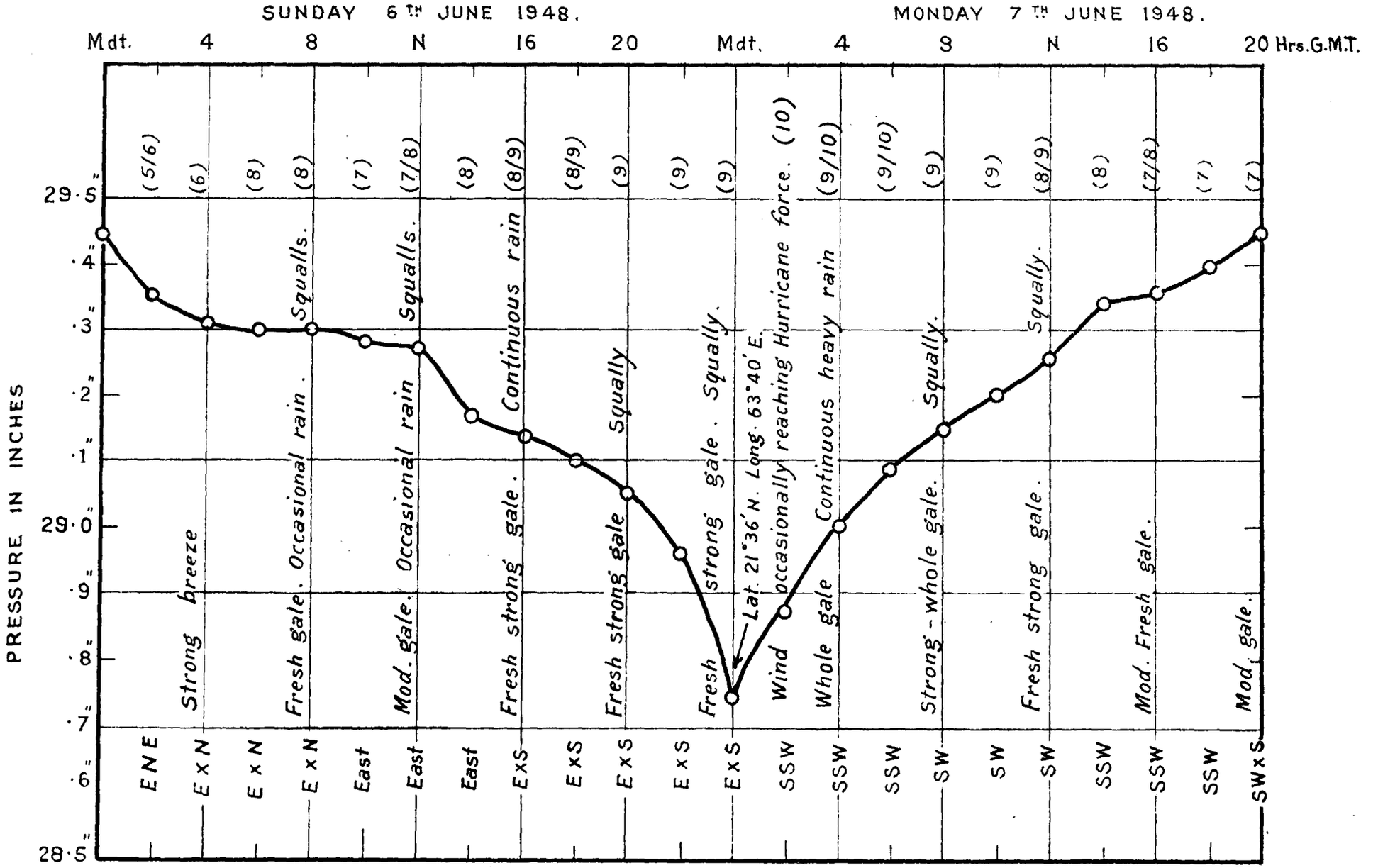
Moving eastnortheast after 1700 hrs. I.S.T. of the 20th, the severe cyclonic storm was entered near Lat. 19° N., Long. 69½° E., at 0800 hrs. I.S.T. of 21st. The Ship S. S. Stanvac Sydney reported at 0400 hrs. GMT. SSE., 6 B.F. winds at Lat. 19½° N., Long. 70½° E. The upper winds over Bombay had somewhat strengthened between 0800 and 1600 hrs. of the 21st. At 1700 hrs. of the 21st, the severe cyclone was centred near Lat. 19½° N., Long. 70½° E. It moved practically east thereafter and at 0800 hrs. I. S. T. of the 22nd, it was very near the north Konkan coast about 50 miles to the northwest of Bombay. The pressure deficiency at the centre of the storm at this stage must have been of the order of 20 mbs. The severe cyclone crossed the coast near Virar (45 miles north of Bombay) at about 0930 hours of the same day, when the maximum wind speed in gusts recorded at Colaba was 80 m. p. h. and at Juhu (16 miles north of Colaba) 94 m.p.h. It has been observed that the falling of trees and telegraph poles were in exactly opposite directions to the north and south of Virar. The observations of Harnai, Alibag, Bombay, Dahanu, Surat and Baroda at different hours between 0800 hrs. of 21st and 1100 hrs. of 22nd together with their weather diaries are reproduced in the Appendix I.

The anemogram and Barogram of Colaba are also reproduced in *fig.* 2.

It is of interest to note that this cyclone had, through most of its life history, much stronger winds to the south of the centre than to its north. From the available ships' observations, it also appears that the steady wind force in the field of the cyclone did not exceed B. F. 10 till the evening of the 21st.

The severe cyclonic storm, after crossing the coast weakened rapidly and at 1700 hrs. I.S.T. of the same day lay as a deep depression about 45 miles to the northnorth-east of Bombay. In the course of the night, it weakened into a depression and at 0800 hrs. I.S.T. of the 23rd it was centred between Aurangabad and Jalgaon. It weakened further thereafter and lay as a trough over Khandesh and Madhya Bharat at 0800 hrs. I.S.T. of the 24th and became unimportant by 1700 hrs. of the same day.

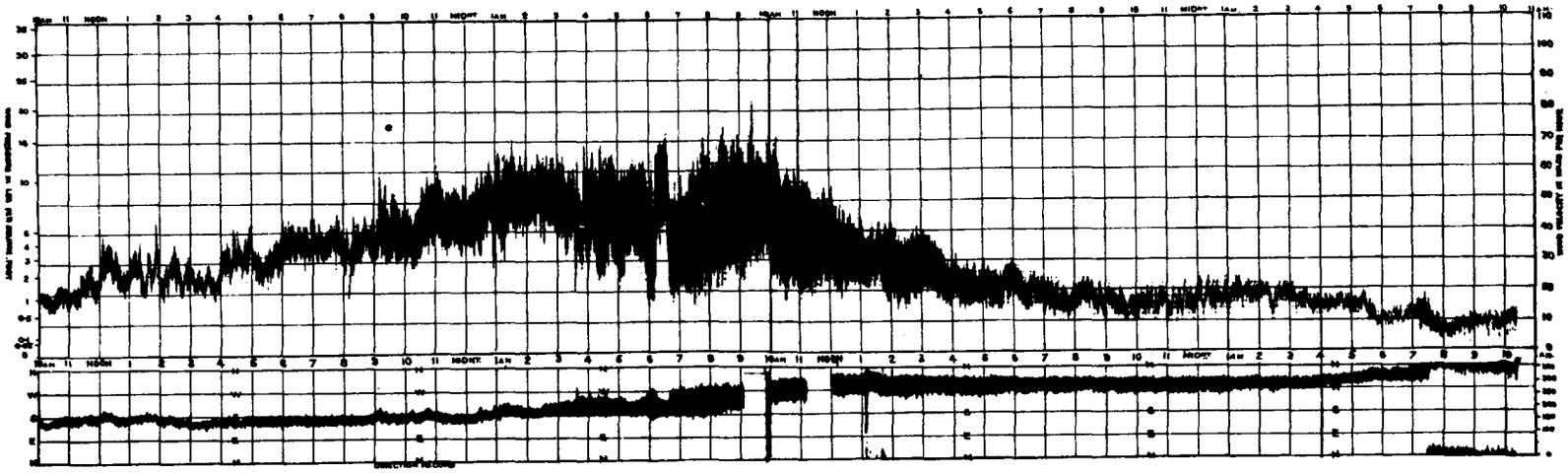
The cyclone caused great havoc and heavy loss of life and property in Bombay where all means of traffic and communications were completely paralysed for two days. A number of sailing vessels and smaller crafts capsized in the waters of the Bombay Harbour. 47 men manning S. S Dipavathi were drowned in the sea. The storm left a trail of destruction throughout the city of Bombay and its suburbs. Besides the damage to the docks and sailing craft, hundreds of buildings and hutments were rendered uninhabitable causing great hardship to the refugees in their camps. Thousands of big trees were also uprooted.



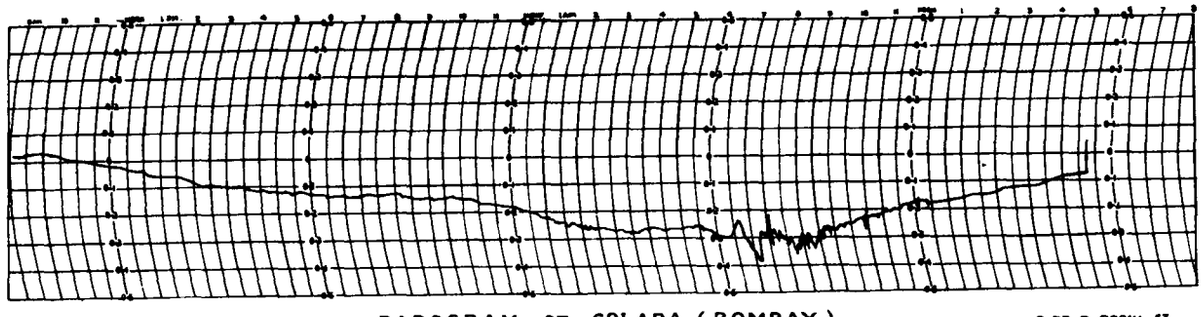
OBSERVATIONS RECORDED BY S.S.SCHWEDAGON.

FIG.1.

G. PZ. P. POONA, 53.



ANEMOGRAM OF COLABA (BOMBAY)
21ST-23RD NOVEMBER 1948.



BAROGRAM OF COLABA (BOMBAY)
21ST - 22ND NOVEMBER 1948.

G.P.E.P. POONA, 53.

FIG. 2.

Associated with the formation and movement of the cyclone widespread rain also fell in southeast Madras, Mysore and Malabar from 18th to 20th and from Kathiawar and south Konkan to west Central Provinces and west Central India from the 21st to 24th. The rainfall also extended into southeast Rajputana, east Central India, northeast Central Provinces, Chota Nagpur and the southern districts of the east United Provinces on the 24th and 25th. Rainfall was locally heavy in the north Konkan, the north Deccan, west Central India and the west Central Provinces. Noteworthy amounts of rainfall of 4″ and above in connection with this storm are also given below :—

TABLE 13

Province and District	District average on		Particularly heavy falls
	22nd	23rd	
BOMBAY			
Poona	2.3″	5.2″	23rd: Vadgaon 5.3″, Lonavala 10.0″, Khed, 5.0″, Alandi 4.7″, Ghoda 5.2″.
Thana	4.7″	2.3″	22nd: Thana. 7.1″, Kalyan 5.5″, Shahapur 4.9″, Bassein 7.5″, Mahim 7.3″, Dahanu 10·1″.
			23rd: Kalyan 4·8″, Shahapur 5·6″, Vade 9·1″.

TABLE 13—*contd.*

Province and District	District average on		Particularly heavy falls
	22nd	23rd	
Kolaba	3.8″	2.5″	22nd: Alibag 5.3″, Uran 4.5″, Matheran 4.7″, Pen 4.2″, Rohe 6.5″.
			23rd: Panvel 4.0″, Karjat 4 0″, Matheran 8.7″.
Ratnagiri	..	..	23rd: Devgad 9.5″.
Satara	..	..	23rd: Mahabaleshwar 5·9″.
Ahmednagar	..	2.0″	23rd: Ahmednagar 4·9″.
Kanara	..	..	23rd: Karwar 5.5″, Ankola 4 8″.

APPENDIX I

TABLE 14

Station	Date	Time IST	Pressure	Wind Dir.	Wind Force	Cloud	Weather	Rain for 24 hours	Weather Diary for the day
Marnai	21-11-48	0800	1008·2	SE	2 BF	6/10 Ac Cu	—	0·29″	
,,	21-11-48	1700	1005·4	SSE	6 BF	—	Rain	—	
,,	22-11-48	0800	1006·5	SSE	5 BF	6/10 Ac Cu	Rain & fog	0·60″	
Alibag	21-11-48	0800	1009·0	ESE	1 BF	Overcast	—	0·13″	Completely overcast sky with Cu Sc Cb Ac As and Ns clouds throughout the whole day. Ci and Cs cloud towards morning only. Slight continuous rain between 0535 and 0615. Slight intermittent rain between 1300 and 1830; and occasional thunder and lightning between 1800 and 0000. Heavy continuous rain between 1315 and 1520. Slight intermittent rain between 1600 and 0000 IST. Southwesterly strong wind began to blow at about 1300 and wind force went on continuously increasing and it developed into strong gale at about 2030 with force continuously increasing with time and the sea getting more and more rough.
,,	22-11-48	0800	1003·3	SW	13 BF	Overcast	Thunder-storm	4·20″	Southwesterly strong gale which began the previous night assumed terrific proportions by midnight and a hurricane of probably unprecedented severity raged from 0100 to 1000 IST. and was probably severest between 0400 and 0500 IST. between which the wind speed might have been above 100 mph. Wind speed at 0800 hrs. met. observation was 80 mph., sea and swell appeared to be abnormally high. Number of trees were uprooted in the vicinity; tiles etc. from the buildings were blown away. After 1000 wind force slightly diminished and by about 1700 the storm almost subsided. Occasional thunder and lightning between 0000 and 0900. Slight intermittent rain between 0000 and 0100 and moderate to heavy continuous rain between 0150 and 0825 and slight intermittent rain 1008 and 1110. The sky was completely overcast throughout the whole day with Cb, Sc, Ac, Fb and Ns clouds.
Dahanu	21-11-48	0800	1009·0	ESE	3 BF	Overcast	—	1·16″	Morning overcast; rain commenced at 2015 and lasted 2400. At 1700 overcast with As. Even Fb, As present with lightning and rain commenced at 2200 hrs.
,,	21-11-48	1700	1003·6	ESE	4 BF	Overcast	—	—	
,,	22-11-48	0800	996·3	ESE	9 BF	Overcast	Heavy storm with rain	10·10″	Overcast since previous evening; rain commenced at 2200 hrs. Wind force 9 with gale which commenced at about 0500 hrs. and lasted till 1000 hrs. Force was above 7 at 1700 overcast As. Cu.
Surat	21-11-48	0000	1008·2	NE	1 BF	Overcast	—	1·90″	Sky continued to be overcast throughout the day with Cu. Sc and As clouds. 7-8/10 Fb clouds in the early morning height of base between 1000—2000 ft. Moderate continuous rain continued till 0310 IST. commencing from 2105 of the previous night. Surface wind mainly between NE to E gusty early in the morning when force reached upto 18 mph. Otherwise light variable throughout. Visibility good.
,,	21-11-48	1100	1009·8	NE	1 BF	Overcast	—	—	
,,	21-11-48	1400	1009·8	NE	1 BF	Overcast	—	—	
,,	21-11-48	1700	1006·6	NE	2 BF	Overcast	—	—	
,,	22-11-48	0200	1003·4	E	5 BF	Overcast	Raining	—	22-11-48—Sky overcast with Cu, Sc, and As clouds continued since previous night and remained so throughout the day, 3-4/10 Cb clouds early in the morning till 0500 hrs. IST. and disappeared later. Moderate continuous rain till 0315 commencing from 1950 hrs. of the previous day. Surface wind between NE-E gusty in the morning force rising upto 20 mph., 8—10 mph. thereafter till evening. Visibility good.
,,	22-11-48	0500	1002·0	ENE	4 BF	Overcast	—	—	
,,	22-11-48	0800	1003·8	NE	3 BF	Overcast	—	0·32″	
,,	22-11-48	1100	1004·7	NE	4 BF	Overcast			
Baroda	21-11-48	0800	1010·1	N	2 BF	Overcast	Drizzle	1·70″	21-11-48—Gusty winds. Sky overcast with Sc, Ac, As; sun hardly visible. Intermittent rain and drizzle throughout the day. Visibility good. Continuous rain from 1430 to 1630. Night light intermittent showers with drizzle.
,,	21-11-48	1000	1010·7	NE	1 BF	Overcast	—	—	
,,	21-11-48	1500	1005·8	NNE	2 BF	Overcast	Drizzle	—	

TABLE 14—*contd.*

Station	Date	Time IST	Pressure	Wind Dir.	Wind Force	Cloud	Weather	Rain for 24 hours	Weather Diary for the day
Baroda	21-11-48	1700	1005·3	NE	4 BF	Overcast	Drizzle	—	**22-11-48**—Wind unusually gusty. Sky practically overcast with Sc, Cu, Ac, As, but no rain. Sun hardly visible. Large cumulus developed in afternoon and there were dark patches of showers falling from the clouds towards N, E, and S. But no showers towards station. Visibility very good.
,,	22-11-48	0800	1007·4	NE	5 BF	Overcast	—	0·29″	
,,	22-11-48	1000	1008·2	NE	5 BF	Overcast	—	—	
Colaba	21-11-48	0800	1008·1	SE	4 BF	Overcast	—	0·10″	Sky overcast with Sc, As, since last midnight. Wind force increased with gusts from 0910. Light rain showers at 1035 with wind SSE force 22 mph. Thunder heard frequently from 1100 to 0000.
,,	21-11-48	1100	1008·4	SSE	5 BF	Overcast	—	—	
,,	21-11-48	1400	1006·0	S	6 BF	Overcast	—	—	Wind force and frequency of rain showers began to increase from 1410. Weather became worse with the progress of the day. A gust of wind reached 63 mph. at 2155, hourly average force being 42 mph. with no change in wind direction. Bar pressure began falling. The sea was very rough from evening till evening of next day.
,,	21-11-48	1700	1004·0	SSE	7 BF	Overcast	—	—	
,,	21-11-48	2200	1003·1	S	8 BF	Overcast	—	—	
,,	22-11-48	0200	999·0	SSW	9 BF	Overcast	—	—	
,,	22-11-48	0500	998·9	SSW	9 BF	Overcast	—	—	**22-11-48**—Bar continued to fall. Sky overcast with As and Sc in large amounts coming from south. Thunder and lightning continued since yesterday upto 0900 hrs. Moderate continuous rain with heavy showers intermittently from 0000—0310. Heavy continuous rain 0310—0455. Moderate continuous rain 0455—0600. Slight continuous rain 0600—0825. Wind force at midnight 48 mph. direction SSE, continued to increase and reached an average velocity of 58 mph. (SSW) individual gust being 77 mph. at 0715 when Bar rapidly fell to 29·42″. Wind force increased further and a gust reached 80 mph. at 0935 IST., average velocity at that time being 50 mph. Wind SSE at midnight gradually changed to SW at 1000 and later to W. Bar continued to fall and became unsteady from 0600 to 1100, rapid variation in bar pressure between 0600—0730, the lowest pressure being 29·42″. Wind force (W) gradually decreased from about 1100 to midnight, average velocity being 16 mph. direction WNW at midnight. Moderate continuous rain 1145—1240. Sky covered with Sc and Ac throughout day and night. Bar began to rise from about 0900, reading 29·72″ at 1900. Several trees in the observatory compound had fallen due to the wind.
,,	22-11-48	0800	997·6	SW	7 BF	Overcast	Rain	3·97″	
,,	22-11-48	1100	1000·7	W	10 BF	Overcast	—	—	

II—ACCOUNT OF WESTERN DISTURBANCES DURING 1948

The western disturbances and their active secondaries in January gave excess of rainfall over most parts of northwest India and the central parts of the country. Those in the second half of February and the first half of March were responsible for excess of rainfall in Western Pakistan, the East Punjab, Rajputana and the west United Provinces. The majority of the disturbances which affected weather in northern India in April and May were feeble, with the result that rainfall was in moderate to large defect during these months over northwest India and the west United Provinces. During the last quarter of the year, the western disturbances were generally feeble, resulting in scanty rainfall over most parts of northwest India in November and practically over the whole of northern India in December.

A list of 63 disturbances classed according to the nature of the precipitation caused by them is given in the table below. A detailed account of some of the more important western disturbances is also added :

TABLE 15

Nature of precipitation	Number of western disturbances											
	January	February	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
Widespread	2	5	3	1	1	..	..	..	..	..	..	1
Local	4	..	2	3	..	2	..	..	1	1	..	2
Little or no rain	2	3	4	3	2	..	3	2	2	3	5	6
Total	8	8	9	7	3	2	3	2	3	4	5	9

1. Western disturbances of 14th to 23rd February 1948.—A western disturbance which began affecting Baluchistan on the 14th evening was over west Baluchistan on the 15th morning. Moving slowly northeastwards it lay as 'an active low' over Rajputana on the 18th and over east Central India and the neighbourhood on the 19th and became unimportant on the 20th. It caused scattered or local thundershowers in Baluchistan and Sind on the 17th and 18th and local thundershowers in Rajputana and the west Punjab on the 18th. Widespread thunder-rain also fell in the United Provinces and local rain in Chota Nagpur and Bihar on the 19th. Two other active western disturbances followed in quick succession. The first began affecting Baluchistan on the 18th and moved away through the East Punjab on the 19th. The second disturbance which began affecting west Baluchistan on the 19th moved northeastwards across the North West Frontier Province. It induced a secondary low in the north Arabian Sea off the Mekran coast on the 20th which moved inland and lay as an extended low pressure area from west Rajputana to the East Punjab on the 21st. Continuing to move northeastwards, it passed away across the western Himalayas by the 23rd. These two disturbances and their secondaries were responsible for widespread rain in the West Punjab and Sind on the 19th and 20th, in the East Punjab and west Rajputana on the 21st and in west United Provinces on the 21st and 22nd.

2. Western disturbances of 9th to 16th March 1948.—A western disturbance appeared over Baluchistan on the 9th morning. Moving rapidly eastwards, it lay over south Rajputana on the 10th and merged into the low over the west Punjab by the 11th. The low moved away northeastwards by the 13th. It caused local rainfall in Baluchistan on the 9th and local to widespread rain in the North West Frontier Province, the West and East Punjab, and the west United Provinces between the 11th and 13th with locally heavy falls in the East Punjab hills on the 11th and 12th. A hailstorm which occurred in Amritsar district on 12th is reported to have caused great damage to crops in that district. The heavy rain in the East Punjab hills caused floods in the Ravi river with consequent damage to standing crops. The disturbance induced a secondary low over the north Arabian Sea off the Mekran coast on the 10th, which moving inland lay over Sind and southwest Rajputana on the 11th and over west Central India and the adjoining parts of north Central Provinces on the 12th. Continuing to move eastwards, it lay as a shallow low over Chota Nagpur and south Bihar and the adjoining districts of east United Provinces, on the 13th, and over north Bihar and sub-Himalayan West Bengal on the 14th where it became unimportant on the 16th. Under the influence of the secondary, there was widespread rainfall in Lower Sind on the 11th and local to widespread thundershowers in west Rajputana between the 10th and 12th and in Chota Nagpur between the 13th and 15th. Scattered thundershowers also occurred in northeast Central Provinces between the 12th and 14th and in Bihar on the 14th and 15th.

III.—LOCAL STORMS

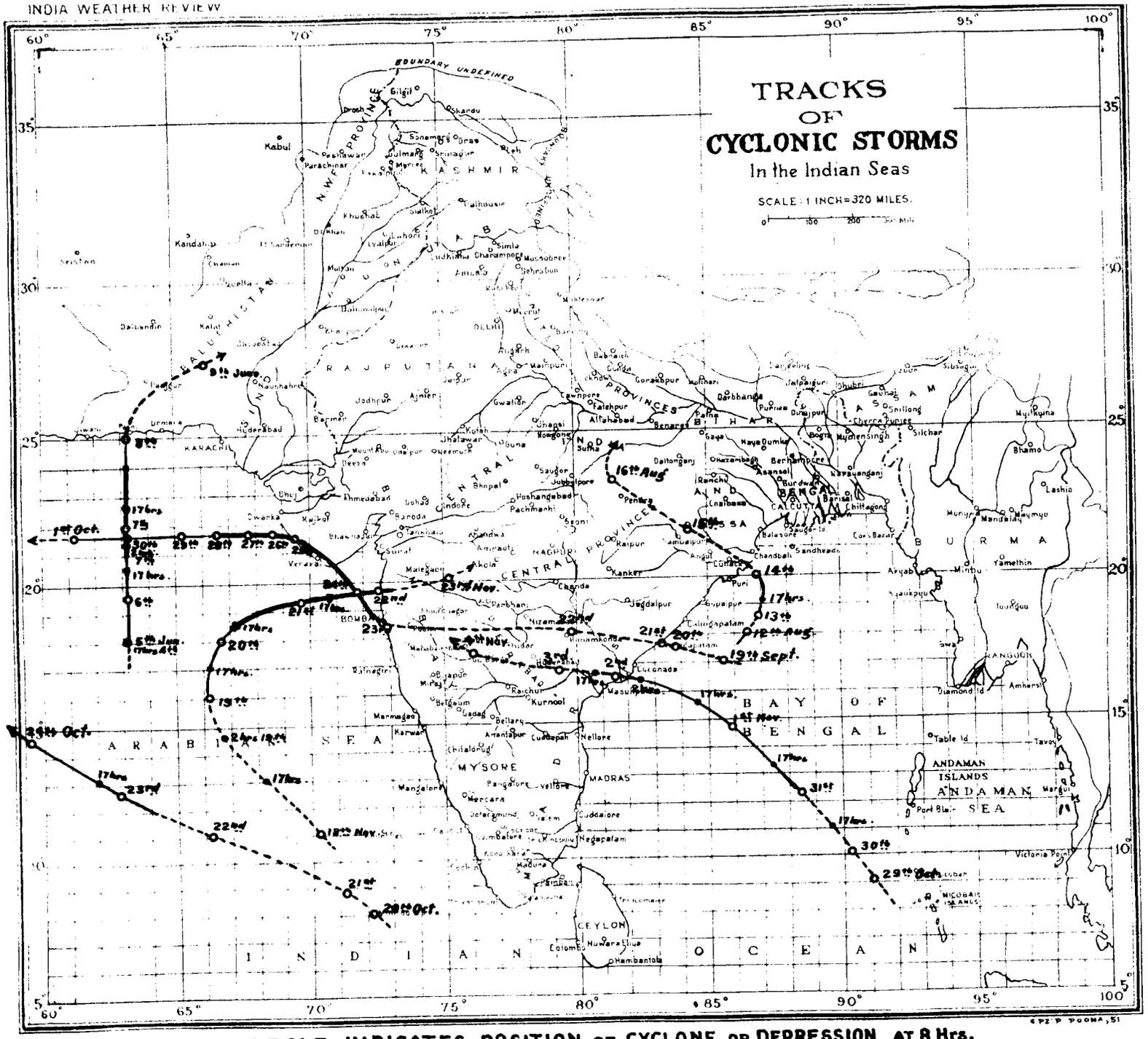
Of the local storms reported in newspapers the following are noteworthy:

Place	Date	Time	Classification of storm	Loss of human life	Remarks
Amritsar (Punjab) .	12th March	..	Severe hailstorm	..	Pathankot-Kulu road was interrupted. Great damage was done to gram.
Calcutta . . .	14th March	Afternoon	Hailstorm	..	Some hailstones are reported to have been over one inch in diameter. Heavy rainfall flooded low lying areas; traffic was interrupted; roofs were blown off and electric supply failed in some parts of the city. Some sections of the All India Exhibition in the Eden Gardens were damaged. Considerable damage was also caused to mango crops.
Calcutta . . .	30th March	Evening	Nor'wester	..	One injured. A few roofs were blown off. Tram services were interrupted for a short time; street lamps went out.
Tirupur (Madras) .	1st April	Evening	Moderate thunderstorm accompanied by squall	..	Caused slight damage here and there and dislocate traffic for some time. Electricity also failed.
Tezpur . . .	7th April	Night	Thunderstorm	1	Telegraph lines in some places were damaged. Heavy damage to property in the villages was also reported. One person was killed and several others seriously injured.
North Malabar . .	19th April	..	Thunderstorm	..	Many banana plantations and tapioca gardens were destroyed. Numerous trees were uprooted and some school buildings collapsed while the roofs of many houses were blown away. In one village, the damage was estimated at one lakh of rupees.
Madras . . .	26th April	..	"Whirling dust-storm".	..	Enveloped the city in semi-darkness for some time. The pedestrians were almost swept off their feet.
Hyderabad (Dn.) . .	26th April	Early morning.	Thunderstorm	..	Trees were uprooted. Telegraph, telephone and electic wires were damaged.
Nagpur . . .	26th & 27th April	..	Dust and thunderstorm.	..	..
Bangalore . . .	10th May	Afternoon & evening.	Severe thunderstorm.	4	Uprooted a large number of avenue trees causing road blocks and traffic interference. The city was plunged in darkness.
Balua (Banaras) . .	10th May	Morning	Duststorm	25	A boat capsized in the Ganga resulting in the drowning of 25 persons.
Jamshedpur . .	22nd May	..	Thunderstorm	1	Roof of a building collapsed as a result of which one person died and twelve others were injured.
Tundla (United Provinces).	23rd May	Evening	Severe hailstorm	2	Hails weighing about two seers fell. It caused dislocation of traffic; considerable damage is reported to have been caused to the electric fittings on the platform and signals and electric and telephonic lines were interrupted by uprooted trees. Many houses were damaged. Some cattle were also killed.
Ahmedabad . .	25th & 26 May	Evening	Duststorm	..	..
Amraoti . . .	7th June	Night	Thunderstorm	..	..
Indore . . .	11th June	Afternoon	Thunderstorm	..	Trees were uprooted and roofs were blown away in the suburban area. Some exhibition stalls and a temporary stage collapsed. A few persons sustained injuries.
Kolhapur . . .	11th June	Evening	Thunderstorm	..	..
Godhra (Bombay) .	21st June	Night	Thunderstorm	..	Several trees were uprooted and walls collapsed.
Ahmedabad . .	24th June	..	Thunderstorm	..	The squall which preceded the thunderstorm brought all traffic to a standstill for sometime.
Arkeri (Bijapur) . .	11th October	..	Thunderstorm	1	Lightning struck a two-storeyed building damaging the walls of electric installations. Low lying areas were flooded.
Secunderabad . .	18th October	Night	Squall	..	Roofs of huts were blown off.

IV.—WINDS OF FORCE NINE OR MORE IN INDIAN SEAS

Excluding dates of storms and depressions a description of which has been given above, winds of force nine or more were recorded on ships in the Indian seas during the year 1948 on the following occasions :

	Month & Date	Name of ship	Approximate position Latitude °N	Longitude °E
1.	15th Mar.	S. S. Singu	12	91
2.	14th July	S. S. Mekala	13	52
3.	8th Aug.	S. S. Glasgow	17	57
4.	10th Dec.	H. M. I. S, Delhi	7	79

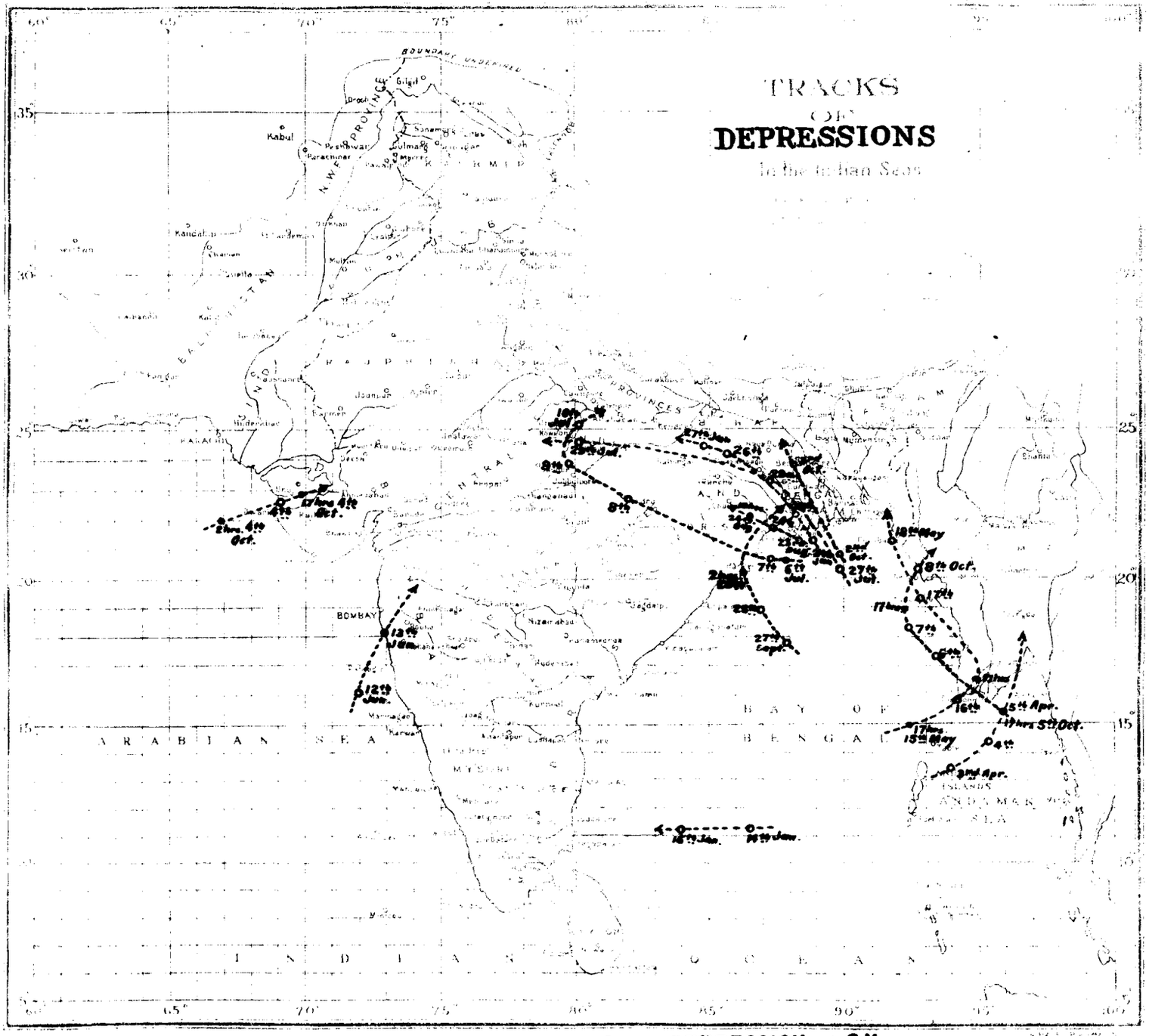


CIRCLE INDICATES POSITION OF CYCLONE OR DEPRESSION AT 8 Hrs.

---------- *Depression.* ——— *Storm.* ▬▬▬ *Severe Storm.*

The portion of the track of the storm of 20th to 28th October which has not been shown in the map above is defined by the following positions :-

0800 hrs. of 25th Oct. 17°N. 56°E. 1700 hrs. of 25th Oct. 17·5°N. 55·5°E. 0800 hrs. of 26th Oct. 24·5°N. 54·5°E.



CIRCLE INDICATES POSITION OF DEPRESSION AT 8 Hrs.

PUBLICATIONS OF THE INDIA METEOROLOGICAL DEPARTMENT

(Complete list, upto July 1952, including those Publications which are now out of print.)

Notes:—

1. ALL THE PRICED PUBLICATIONS EXCEPTING THE DAILY, WEEKLY AND MONTHLY WEATHER REPORTS, AND THOSE ITEMS WHICH ARE 'OUT OF PRINT' ARE AVAILABLE FOR SALE WITH THE MANAGER OF PUBLICATIONS, CIVIL LINES, DELHI-8.
2. INDIAN DAILY WEATHER REPORT, WEEKLY WEATHER REPORT, AND MONTHLY WEATHER REPORT ARE AVAILABLE FOR SALE IN THE OFFICE OF THE DEPUTY DIRECTOR GENERAL OF OBSERVATORIES (FORECASTING) METEOROLOGICAL OFFICE, POONA-5.
3. DAILY REGIONAL WEATHER REPORTS FOR CALCUTTA, NEW DELHI, NAGPUR, BOMBAY AND MADRAS ARE AVAILABLE FOR SALE AT THE RESPECTIVE REGIONAL METEOROLOGICAL CENTRES.

I. GENERAL.—

Instructions to observers at the 2nd and 3rd class observatories, edition 3 (1943). Rs. 1-10 or 2*sh.* 6*d.* *(Revised edition in press.)	Departmental.
Cloud Atlas, edition 3 (1945). Rs. 2-2 or 3*s.* 6*d.**	Ditto.
Tables for the Reduction of Meteorological Observations in India, Reprint of 3rd edition (1947). Rs. 5-12.	Ditto.
Relative Humidity Tables (1937). As. 7 or 9*d.**	Ditto.
Hygrometric Tables (1000 mb.) edition 2 (1949). As. 14 or 1*s.* 3*d.*	Ditto.
Hygrometric Tables (900 mb.) edition 2 (1948). Rs. 1-14 or 2*s.* 9*d.*	Ditto
Hygrometric Tables (800 mb.) edition 2 (1949). Rs. 2-12 or 4*s.* 6*d.*	Ditto
Hygrometric Tables (700 mb.). 1944.	Ditto.
Hygrometric Tables, Vapour Pressure. Rs. 3-8 or 5*s.* 6*d.*	Ditto.
Saturation Temperature Tables (1942). As. 10.	K. N. Rao.
Rainfall Organisation (1929). As. 2.	Departmental.
Service Instructions for Part-time Observers (1952).	Ditto.
Instructions for making entries in Pocket Register and Monthly Meteorological Register (in press).	Ditto.
Weather Code (1949). As. 12 or 1*s.**	Ditto.
Brief Weather Code (1949). Rs. 1-6 or 2*s.*	Ditto.
Aviation Weather Codes (1949). As. 8 or 9*d.*	Ditto.
Codes for reporting upper Winds and Cloud Directions (1949). As. 7 or 8*d.*	Ditto.
Code for Upper Air Reports (1949). As. 9 or 10*d.*	Ditto.
Ships' Weather Code (1949). Rs. 1-10 or 2*s.* 6*d.*	Ditto.
Reports on the Meteorology of India for the years 1875—1890 (16 volumes). Each Rs. 10.†	Ditto.
Meteorology of the Bombay Presidency (1878).	C. Chambers.
Weather and the Indian Farmer (1946).	Departmental.
Meteorology in India.	Ditto.
Kodaikanal Observatory (1901—1951). Re. 1.	Ditto.

II. AVIATION METEOROLOGY.—

Meteorology for Airmen in India—	
Part I—General Meteorological features. Edition 2 (1949). Rs. 4-10 or 7*s.* 3*d.*	Ditto.
Part II—Climatology of Air Routes (1936).* Rs. 2-2 or 4*s.* 10*d.*	Ditto.
India's Climates—Summary for Airmen (1943). Re. 1 or 1*s.* 6*d.*	Ditto.
Meteorological Organisation for Airmen. M.O.A. pamphlet (1949).	Ditto.
Meteorological Conditions affecting aviation over the Northwest Frontier (1934). Rs. 1-8 or 2*s.* 6*d.*	R. G. Veryard and A. K. Roy.

III. ATLASES AND CHARTS.—

Climatological Atlas of India (1906).* Rs. 27.	Sir John Eliot.
Meteorological Atlas of the Indian seas and the North Indian Ocean (1908).* Rs. 13.	W. L. Dallas.
Monthly Weather Charts of the Bay of Bengal and adjacent sea north of the equator, showing mean pressure, winds and currents (1886).* Rs. 5.	H. F. Blanford.
Monthly Weather Charts of the Arabian Sea and the adjacent portion of the North Indian Ocean showing mean pressure, winds and currents (1888). Rs. 5.	Sir John Eliot.
Charts of Bay of Bengal and adjacent sea north of equator showing specific gravity, temperature and currents of the sea surface (1887). Rs. 1-8.	W. L. Dallas.
Daily Weather Reports and Charts of the Indian Monsoon Area for the Years 1893 to 1899, each month. Re. 1*.	Departmental.
Normal Weather and Pilot Charts of the Indian Monsoon Area for 8 a.m. for each month Novermber 1900 to August 1908, each month. As. 4.*	Ditto.
Storm Tracks in the Bay of Bengal (1925). Rs. 3-6 or 5*s.* 9*d.**	C. W. B. Normand.
Storm Tracks in the Arabian Sea (1926). Rs. 3-8 or 6*s.**	Ditto.
Climatic Charts of India and Neighbourhood for Meteorologists and Airmen (1943).*	Departmental
Climatological Atlas for Airmen (1943). Rs. 3-2 or 8*s.*	Ditto.
Climatological Charts of the Indian Monsoon Area (1945). Rs. 16 or 25*s.*	Ditto.

IV. CYCLONE MEMOIRS, ETC.—

Handbook of Cyclonic storms in the Bay of Bengal for use of Sailors—	
Vol. I—Text. 2nd edition (1900). Rs. 4.*	Sir John Eliot.
Vol. II—Plates. 2nd edition (1901). Rs. 1-8.*	Ditto.
Handbook of Cyclonic storms in the Bay of Bengal (Abridged) 1943. Re. 1.	Departmental.
Cyclonic Memoirs—	
Part I—Bay of Bengal Cyclone of May 20th to 28th, 1887 (1888). Re. 1.*	Ditto.
Part II—Bay of Bengal Cyclone of August 21st to 28th, 1888 (1890). Rs. 3.	Ditto.

* Out of print.

† Copies for the years 1875 , 1876, 1878 to 1881, 1884, 1887, and 1890 are out of print.

CYCLONE MEMOIRS, ETC.—(contd.)

Cyclonic Memoirs--(contd.)

Part III—Bay of Bengal cyclones of September 13th to 20th and October 27th to 31st, 1888 and Arabian Sea cyclone of November 6th to 9th, 1888 (1890). Rs. 5.	Departmental.
Part IV—An enquiry into the nature and course of storms in the Arabian Sea and a catalogue and a brief history of all recorded storms in the Arabian Sea from 1848—1889 (1891). Rs. 3.	W. L. Dallas.
Part V—Account of three cyclones in the Bay of Bengal and Arabian Sea during November 1891 (1893). Rs. 3.*	Sir John Eliot.
Report of the Midnapore and Burdwan Cyclone of the 15th and 16th of October 1874 (1875). Rs. 3.*	W. G. Wilson.
Report of the Vizagapatam and Backergunge Cyclones of October 1876 (1877). Rs. 3*	Sir John Eliot.
Report on the Madras Cyclone of May, 1877, (1879). Rs. 3*	Ditto.
Winds, Weather and Currents on the coasts of India and the laws of storms, edition 2 (1942). Rs. 2-2 or 3*s.* 6*d.*	Departmental.

V. CLIMATOLOGICAL TABLES, ETC.—

Five-day Normals of Maximum and Minimum Temperatures and Accumulated Rainfall (1931). Rs. 4 or 6*s.* 6*d.*	Ditto.
Five-day Normals of Pressure at 9 hrs. I. S. T. (1943). Rs. 2-2 or 3*s.* 6*d.*	Ditto.
Five-day Normals of Pressure at 18 hrs. I. S. T. (1943). Rs. 1-12 or 2*s.* 6*d.*	Ditto.
Five-day Normals of Relative Humidity at 9 hrs. I. S .T. (1944). Rs. 2-8 or 4*s.*	Ditto.
Five-day Normals of Relative Humidity at 18 hrs. I.S.T. (1943). Rs. 2-2 or 3*s.* 6*d.*	Ditto.
Climatological Tables of Observatories in India (in press).	Ditto.
Aviation Climatological Tables (1944). Rs. 8-8 or 13*s.* 6*d.*	Ditto.

VI. SCIENTIFIC NOTES.—

Vol. I—

No. 1.	Comparison of upper gradient winds, Agra and Bangalore. Re. 1-3 or 2*s.**	Mohamad Ishaque.
No. 2.	An analysis of the Madras hourly rainfall records for the years 1865 to 1875 and 1901 to 1917. As. 9 or 1*s.*	V. Doraiswamy Iyer.
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No. 6.	Correlation between pre-monsoon conditions over N. W. India and subsequent monsoon rainfall over N. W. India and the Peninsula. As. 6 or 9*d.*	M. V. Unakar.
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Vol. II—

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